

POPULAR Computing WEEKLY

16 September 1982 Vol 1 No 22

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The Team

Editor

Brendon Gore

Reporter

David Kelly [01-930 3271]

Sub-editor

Ninette Sharp

Editorial Secretary

Fiona McCormick

Advertisement Manager

David Lake [01-839 2846]

Advertisement Executive

Alastair Macintosh [01-930 3840]

Managing Editor

Duncan Scot

Publishing Director

Jenny Ireland

Popular Computing Weekly,
Hobhouse Court, 19 Whitcomb Street,
London WC2
Telephone: 01-839 6835

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Articles which are submitted for publication
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At present we cannot guarantee to return
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Accuracy

Popular Computing Weekly cannot accept any
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publish, although we will always try our best to
make sure programs work.

This Week



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Editorial

In a week when they found George
Washington's teeth, and a boy who is
allergic to Scunthorpe, Commodore
announced a £30 cut in the price of its
Vic20. From September 28 the Vic20
will cost £169.99 including VAT.

This move, which had been
rumoured ever since Sinclair launched
the ZX Spectrum in April, is an attempt
to undercut some of the other low-cost
micros on the market. The Dragon 32,
the TI 99/4A, the Atari 400 and now
the Lynx, are all priced around the
£200 mark.

With more micros likely to appear in
the near future — they seem to be
averaging almost one a week at the
moment — the market is becoming
increasingly price sensitive.

Commodore has the advantage of
an established user base and a wide
range of software. But price is still a
crucial factor for prospective buyers.

In the past two months, Sinclair has
dropped the price of its ZX81 by £20,
to £49.99, and Texas Instruments and
Atari have cut more than £100 off the
price of their micros. Now Commodore
has followed suit.

If this competition among micro
manufacturers continues, prices may
yet drop further.

Next Week



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is no joke in Kong's
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Vic20 price drops by £30

COMMODORE has announced two moves to boost sales of the Vic20 range of products and software.

The price of the Vic20 is to be cut by £30 to £169.99 including VAT, from September 28. This drop takes the machine out of the competitive £200 region and places it between the two versions of the ZX Spectrum.

Over 55,000 Vic20 machines have been sold in the eight months since its launch, compared with over 40,000 Sinclair machines since Spectrum's April launch.

In the second move, Commodore has set up a Vic20 owners club, Vic-Soft, which will send the first issue of its new quarterly magazine to more than 25,000 Vic20 owners who completed and returned their guarantee cards.

A Commodore spokesman explains "Vic-Soft will be a place where owners will be first to find out about new things for their machines."

Further issues and special offers will be available to those who join and pay the club's £5 membership fee.

Prestel database for micros

PRESTEL is making a determined effort to capture the home computer market. A 30,000 page database is being set up just for micro users.

This scheme, known as Micronet, will be launched in January. The database will contain games, programs and information about computers and user groups.

As an added incentive, Prestel plans to reduce its charges for evenings and weekends.

Croydon venue for microfair

CROYDON Home Computer Fair will be held in the Greyhound Halls, Park Lane, Croydon on Saturday, September 25.

Over 40 exhibitors will be there, entry will be £1 and 50p and the show will be open from 10 am to 8 pm. More details from Ron Vogt, Computer Fairs, 359 The Strand, London WC2.



Computers' Lynx has 48K Ram and high resolution colour graphics.

Lynx unsheathes its claws

MORE details have emerged about the Computers' Lynx (*Popular Computing Weekly*, September 9).

Based around the Z80A microprocessor, the Lynx has 48K Ram, expandable to 192K, and 16K Rom. It has 24 lines x 40 characters display and a colour resolution of 248 x 256.

The 48K Ram leaves 16K available to the user in the high resolution colour mode. With additional memory expansion, the display can be boosted to 24 lines x 80 characters with a colour resolution of 248 x 512.

An enhanced form of Basic, specially developed for the Lynx by Davis Jansons, takes up 10K of Rom. The remaining 6K is used for the keyboard, monitor and screen driver.

Other features of the Lynx

include a typewriter keyboard, an internal speaker and an RS232 port. To avoid any possibility of overheating, the power supply will be external.

Though the Lynx is designed primarily for the home user, it has CP/M file management compatibility.

The hardware for the Lynx was designed by John Shirreff of G W Design Services, a Cambridge electronics firm. Finance for the project was provided through the government's small firms loan guarantee scheme.

The 48K Lynx, originally priced at £150 plus VAT, will now be sold for £225 including VAT. It will be launched officially in late October.

Computers Ltd has moved from its old address in Hills Road, Cambridge. The firm is now based at 33A Bridge Street, Cambridge CA3 4AB.

Programming award competition winners

POPULAR Computing Weekly's Programming Award Scheme Competition winners have been selected.

First prize goes to Phillip Brain of Crookesmoor, Sheffield, for his program *Odyssey*. He wins a Sinclair ZX Spectrum and a ZX printer.

The winners were selected last week by Brendon Gore, Editor of *Popular Computing Weekly*, and Jeremy Ruston, author and programmer.

Jeremy Ruston commented: "The competition received so many entries of a high stan-

dard that it was very difficult to decide on the winners."

Odyssey was also the winning program in the Games category.

Malcolm Davison won the Educational/Scientific section with the best presented program, *Spelling* for the 16K Spectrum.

D Swindell won the Utilities section with his impressive *ZX81 Assembler*.

Christopher Copper won the Business/Office section with *Business Accounts* for the 16K ZX81.

BBC users in independence squabble

A ROW has broken out between the two main BBC micro user groups concerning their independence.

In a letter to the magazine *Microcomputer Printout*, Sheridan Williams — co-founder of Beebug — has accused rival group Laserbug of ties with a retail outlet. He alleges "Laserbug are run by a shop called Computers For All and cannot represent their members in a truly independent way. As far as I know, the only truly independent user group is Beebug."



Sheridan Williams.

Paul Babbour, new editor of *Laserbug*, in a written reply to the letter says "Laserbug is and always has been independent of all outside bodies. While Mr Williams claims he is completely independent, I would like to know how, in the mail-out by Acorn (which supplied the guarantee card to every owner of the BBC micro) he managed to get a sheet publicising his own group."

Beebug currently has a membership of 8,500. Laserbug now has over 2,000 members.

Commodore 64 goes on sale

THE new Commodore 64 microcomputer will go on sale in the UK during the third week of September.

It will cost £299 plus VAT. At over a hundred and fifty pounds more than the Vic20, it nears the price of the 64 selling in the US at \$599.

A Commodore spokesman said: "There is an enormous perceived demand for the new machine in the UK. The initial batch will be manufactured in Santa Clara, imported, and sold through selected high street retailers."

Letters

write to Letters, Popular Computing Weekly, Hobhouse Court, 19 Whitcomb Street, London WC2

Is this misplaced enthusiasm?

There were a couple of inaccuracies in my program Screenprint which was published in *Popular Computing Weekly* July 29. The Rem statement in line 10030 should say that TS=4096 on Vics with more than 8K of memory and not 10.24. Also, in the accompanying text the calculation for NL should read:

NL=INT((PEEK(36868) AND 127)/2)

I did send in an alternate listing but this was obviously misplaced.

Ken Clark
22 Napier Avenue
Southend-on-Sea
Essex SS1 1LZ

Please help me Mister Postman

I wonder whether any of your readers can help me to obtain a copy of PCW April 29 (Planet Ruler issue). This will then enable me to complete my set of issues of your magazine.

Ian Fensome
7 Brussels Way
Luton
Bedfordshire LU3 3TQ

Penitents' stool

I have spent hours trying to make your Meltdown program work (*Popular Computing Weekly* July 29). I now realise that at least lines 6500 and 7000 are omitted with possible errors in lines 7 and 70.

Can you please advise of these and any other corrections for this program. I must say the very small print made other sections almost unreadable. A great pity as I believe that, errors excepted, the magazine is very good value for money.

M Farrant
49 Waterer Gardens
Tadworth
Surrey

You are correct, there are a couple of errors in the Meltdown program. The original program worked fine when we played it in our office. Unfortu-

nately, our cassette recorder missed out a couple of lines when we printed out the program.

To correct the program, type in line 6500 RETURN and 7000 REM MELTDOWN.

You pays yer money and . . .

I am writing to reply to Mr S Stratford's letter in Peek & Poke (July 22). It will soon be possible to download telesoftware from teletext on the BBC microcomputer — production of the unit begins in October. If Beebusers can't wait, then programs appear on Ceefax along with a tele-software newsletter (page 705).

Ian Beardmore's reply to Mr Stratford said that a ZX Spectrum Prestel adaptor would not be possible "... let alone feasible ...". However, I was delighted to read in the following issue (July 29) that Sinclair are to build such an adaptor likely to cost from £50 — or less. Production starts on a similar adaptor for the BBC micro in early 1983.

Before investing in Prestel it must be remembered that, unlike teletext, it is not free. British Telecom charge on a time-basis for using (a) the telephone line, and (b) the Prestel computer. Some information providers also charge you to look at their pages. Prestel is a brilliant British invention but it is too expensive for the home-user at the moment, just like *Popular Computing Weekly*.

Andrew Wiseman
Hartford Post Office
68 Mayfield Road, Hartford
Huntingdon
Cambridgeshire PE18 7NJ

A partially populated b

I wish to comment on the letter "To b or not to be, that is ..." in July 29.

The model A can be fully upgraded to model B standard for around £130 if done by an Acorn dealer, and around £75 if you fit them yourself.

The only part of the tube that the model A does not have is the connector which can easily be soldered to the board — the model A board is just a partially populated model B board.

Matthew Newman
3 Harvest Bank
Hyde Heath
Amersham
Buckinghamshire

Cubic rethink . . . WHOOPEE

In your competition page I (July 15) you mention errors encountered on comparing cubes, eg: IF 3**3=27 THEN PRINT "WHOOPEE" will fail. However, PRINT 3**3 gives "27" so I thought of using STR\$, eg: IF VAL STR\$ 3**3=27 THEN PRINT "WHOOPEE" will give a happy response every time.

S Haydock
61 Gordon Street
Wigan
Lancashire

Backslashing answer

Ian Beardmore's reply to D Whittaker's query about Vic20 inverse graphics (July 22 issue) was somewhat less than helpful.

The character in question was, in fact, an inverse (or reverse) video backslash. This is not found in the Vic20 character set but does appear in the character set of the larger CBM machines. When Vic20 programs are listed using a printer on one of the larger CBMs, this character is printed in place of the inverse video £ which denotes Ctrl red on the Vic. An example of this appears in Appendix M (page 153) of the booklet *Personal Computing on the Vic20*. Your correspondent should have received a copy of this booklet with his machine.

The reason for this, at first apparently strange effect, is that machines such as the CBM 3000/4000 do not have a £ sign in their character set. There are also slight differences in the versions of the ASCII code employed on the

different machines. On the Vic20 the code for the inverse video £ is 220, on the CBM 3000/4000 this code corresponds to the inverse video backslash.

There should be no confusion with the inverse video diagonal given by shifted M, since the backslash has a vertical ascender/descender at each end.

During his discussion of this problem, Ian Beardmore also reveals an alarming lack of appreciation of the operation of the reverse video controls on the Vic. If you have opened a print statement and then type Ctrl rvs on, an inverse video r will appear on the display, but all subsequent characters will appear as normal until the program is run (or RETURN is pressed in the immediate mode). Then, and only then, will the characters appear in reverse video. Deleting the inverse video r will cancel the command, but the inverse video r will return once you "start again".

On the other hand, in the immediate mode without a print statement, typing Ctrl rvs on will not cause an inverse video r to appear and deleting will not cancel the command — all subsequent characters will appear on the screen in reverse video until Ctrl rvs off is entered.

J Meardon
15 Brightwell
Reabrook
Shrewsbury
Salop SY3 7TQ

Manual error in Sinclair

Thank you for such a wonderful magazine.

The reason why I have put pen to paper is to tell readers that I have spotted a mistake in the Sinclair manual. It only becomes dangerous when using machine code. It is the character on page 184, code 135. The character should be "Shift Graphic 3" and not "Shift Graphic E".

Keith Driscoll
53 Melville Road
Boothle
Merseyside

Street Life

Jupiter Ace — the making of a micro

David Kelly returns to Foxhollow in pursuit of the Jupiter Ace.

Now the Jupiter Ace has arrived (*Popular Computing Weekly*, September 9) the tongues of Altwasser and Vickers have been untied and they can talk about their new micro, the machine that is not afraid to speak Forth.

The two co-designers of the Spectrum left Sinclair five months ago to develop the machine.

"I first thought in November last year that it would be a good idea to build a microcomputer," says Richard.

"I knew that I couldn't do the whole thing on my own. I can't write machine code — at least, I can't write it like Steve can.

"I turned the idea over for some time but it wasn't until January that I mentioned anything to Steve.

"I didn't know how Steve would feel about setting up on his own. I had always thought Steve was a fairly cautious sort of chap and I wasn't sure if he would be interested."

"As we talked it became clear that Steve was prepared to be adventurous — and it became clear to him that I was prepared to be adventurous — and there you are."

Both Richard and Steve wanted to do something different, so they decided that their micro should run Forth rather than Basic.

"We'd been talking before Christmas about Forth," explained Richard. "We had both independently read an article that was printed in the magazine *Byte* — and we both got quite excited about it."

Having decided to build a new micro that would run Forth, the two designers began to sort out the details of the new machine.

"We spent the last weekend in January sitting down trying to work out the basics of the Ace. We both know the Z80 processor inside out so we really had to use it, and at that stage I already had an architecture in mind.

"The Ace had to be fairly inexpensive for two reasons. You can always make a small computer bigger by hanging a selection of peripherals on it — which makes the small micro a better commercial proposition. And we obviously know so much more about making small computers.

"We agreed to spend a month evaluating the project. We both joined FIG, the



Steve Vickers (left) and Richard Altwasser, co-designers of the Jupiter Ace.

Forth Interest Group. Steve went off and bought lots of books and I started making enquiries of component manufacturers."

By mid-March they were still not making much progress and they realised that, if they were going to see the venture through, they would have to leave Sinclair. There was only one time to do that — immediately after the Spectrum launch.

"We couldn't possibly leave before, and, if we waited long after we would more than likely be heading into another of Clive's projects," says Richard. "So we left and went heading into one of our projects instead."

By this time the first draft of the hardware was already working.

"If you look at all the new computers coming out they all have new hardware — ours was to have entirely new software as well. Writing the Forth was a huge task for Steve.

"While he was doing that I redrafted the hardware and designed the printed-circuit board. Mixed in with this I was sorting all the components — looking around the factories for someone to build it. We also approached the bank to try to get a three-month loan.

"Forth is a very well documented language. We decided on Forth 79 Standard, with some modification, and Steve built it all up from scratch.

"To say Basic is becoming the standard language for micros is very misleading — you show me two machines that run the same version of Basic. Forth is a better language. It is about ten times faster than Basic. It is more compact — we could easily do a 1K *Space Invaders* in Forth on the Ace.

"Forth is easier to learn, as the first language. Changing from Basic to Forth is

a bit like going on the continent and driving on the right: You quickly get into the way of it, but in the first 20 minutes you risk your life so many times."

The Jupiter Ace will get its full launch at the *Personal Computer World Show* when the first production run machines will be on display.

"We will build and ship 500 computers in September which will get us off the ground — production will ramp up from there according to demand.

"In addition we are going to provide a memory expansion, although with a little adaptation any Z80 peripheral can be connected because all the Z80 busses appear at the back of the Ace.

"We will be writing our own software for the machine and we are working closely with several companies who have written good things for the ZX81 and have expressed a wish to write for us.

"Most people buy a micro to learn about computers. They spend a week getting into Basic and discover they cannot produce the kind of games they are used to without learning to program in machine-code. That isn't easy so they resort to buying ready-made machine-code games. The manufacturer is selling a Basic machine to run machine-code. What the Ace does is to provide machine-code speed in an easily understood language.

"Learning to program should be easy. If you buy a car it should be as easy to drive as possible. Why should a computer be different? It is the job of designers to produce machines that my grandmother would find easy to use.

"I think," says Richard, "that the introduction of Forth is a major step in that direction. We know we are right to produce the Ace — all we have to do is convince everyone else of that."

COVER STORY

Swarm

A new game for 16K Spectrum
by Simon Lane

An experimental research station at Porton Down is working on a hush-hush project. In a quest to invent a new weapon, to match the Super Powers' terrifying nuclear arsenals, the research team is altering the genetic DNA patterns of various insects.

Black widow spiders, their poisonous bite enhanced a thousand fold, are kept under close observation. Killer ants, bred for size and ferocity, are encased in specially constructed titanium alloy cases. Even beetles, their skins toughened to withstand almost any shock, are being used as instruments of destruction.

The research team's most successful experiment has resulted in a species of hybrid bee. These bees have wingspans of 12 ft, with bodies to match. They are carnivorous and need to feed almost constantly.

Unfortunately, a swarm of the bees escaped from one of the hives. The bees are approaching a nearby city, looking for food.

You are part of an artillery unit called up to deal with the menace. Your rocket launcher is one kilometre away from the swarm, but you only have enough ammunition for one shot at each bee.

When run, the program displays rows of the giant bees on the screen. Using the keys 5, 6, 7 and 8 you must position your sights directly over each bee. Enter 0 to fire.

Full instructions are contained in the program.

User defined graphics are present in lines 80-240, 310, 320, 1087 and 1260.



[illegible]

Reviews

software

Winged Avenger

Work Force, 140 Wilsden Avenue, Luton, Bedfordshire.
Spectrum, 16K or 48K.
Price: £6.95 inclusive.

This is one of the first machine code games available for the Spectrum. It is a colour and sound version of a game previously released for the ZX81.

The cassette loaded with no problems from two different machines and is recorded three times on the tape. It consists of a short Basic program followed by a large chunk of bytes, so it is important not to switch off the machine the first time the screen no longer shows the loading pattern, as there is no warning on the display. As the auto-load stops, there is a brief description of the control keys and a choice of difficulty levels (0 to 6).

In order to discover how well this program emulates its big brother, I set off one dark night into the nether regions of my local fair, armed only with my courage and a pocket full of 10p pieces. The original game, *Phoenix*, sends squadrons of cosmic eggs at you that later hatch into almost indestructible vultures. The vultures pursue you relentlessly, even when their wings have been blown off by your laser cannons.

Smashing opportunity

After this Hitchcockian nightmare, there is the opportunity to smash the control craft which contains smart weapons that lock onto your base (I confess I could not get past this stage).

Work Force's version is one of the best Sinclair games so far. It covers all the stages of the arcade original — the arrival of the mother ship is particularly good. It is certainly a game to come back to again and again.

My one criticism would be that the shield control protects you too well. Kani-kazi birds that reach the bottom line hurl themselves to destruction with little damage to the home base.

In all other respects, *Winged Avenger* seems to offer good entertainment, although £6.95 does seem a little high when compared with games like Bug-Byte's *Spectral Invaders* — which is almost £2 cheaper.

Summary

A well-written high-speed action game that uses the potential of the Spectrum fairly well. Perhaps a little over-priced, but in my long run cheaper than the arcade version — and you might even win!

JS

5-DOWN 7-UP 9-FIRE 0-SOME
FUEL 967 SCORE 0000 HIGH 0000



QS Scramble

QS Scramble
Quicksilver, 92 Northam Road,
Southampton
ZX81, 4K, cassette
Price: £5.50.

At any ZX fair a certain amount of indifference toward humankind is called for when moving from stand to stand.

The Quicksilver stand always attracts impenetrable crowds. Their stand is justly popular — their software and hardware is always first class.

Scramble, their new release, follows the QS tradition of concentrating on the classic arcade games.

The game has the same feel as QS's well-known *Defender* — your spaceship cruises above a changing mountainous landscape, shooting at aliens swooping down from space, and rockets being fired from the ground. In addition, you may drop bombs on the fuel dumps scattered among the mountains. Points, of course, are scored for all of these operations. With the aid of a little insert card, you may change several of the parameters to give a personalised game. You will want to make the game harder after playing a couple of times, as the basic one soon becomes too easy.

The package displays the usual high-quality artwork and the cassette itself is neatly printed with the title of the program. The tape contains, as is usual QS practice, software for the QS character and sound generators.

Summary

"Amazing", "fantastic", and other original observations from neighbouring arcade game fans were enough to convince me that Quicksilver have another worthy addition to their small but select range.

TB

Airline/Autochef

CCS, 14 Langton Way, London SE3.
ZX81, 16K cassette.
Price: £4.75 each — £8.00 both.

One of the most successful types of boardgame has been the business simulation, witness *Acquire*, *Monopoly*, et al. The ZX81 is admirably suited to this type of game — more so, in my opinion, than to the graphic arcade game, excepting the efforts of a very small, distinguished minority.

Airline puts you in the managing director's seat. Your task is to build the company into a viable business, with the help of bar charts, histograms and vicarious news flashes. You must use this information, on crewing levels, freighting profits and so on, to make decisions. As in real life, well laid plans are affected by outside events, in this case hi-jacks and crashes.

The program is broadly realistic. For instance, until capital has been built up to a reasonable level, airplanes cannot be bought, but only leased. Details such as this help to build a convincing insight into the business world.

Autochef is not some new cooking device, but the name of a restaurant chain. Again, you are in charge, and given information relevant to your business. This time you decide what type of establishment to run, what to charge for meals, whether to give your staff pay rises and so on.

Summary

Both programs feature attractive layouts and give the player a good sense of being in control of a big business. Although not detailed enough for the serious student of Business Affairs, the games are an ideal simulation for the interested teenager, and good plain fun for everybody.

TB

Reviews

hardware

Disc drive for ZX81

Macronics, 26 Spiers Close, Knowle, Solihull, West Midlands B93 9ES.

Price: £90.85 for the interface card.
£162.85 for the floppy disc drive.

This is the first disc drive to be demonstrated for use on the ZX81. It can store up to 48K of programs or data on its single sided, single density, discs. The loading speed of 24 seconds per 16K program is slow by normal disc standards, but is 21 times faster than the tape speed.

The user can either supply his own standard disc drive or buy a 5¼ inch disc drive from Macronics (mini-discs will be available soon).

The interface card (5 × 5½ inches) plugs into a motherboard, so that a 16K Ram pack can be used as well as the printer. The motherboard simply plugs into the ZX81 and the drive is connected up via a 21-inch ribbon cable. The drive must be powered up first, but there is no indication on the drive supplied that this has happened.

The board contains a 2K Rom (soon to be expanded to 4K to cope with three drives and a Copy disc routine) which provides the 11 disc commands. There is also 2K of Ram for use by the system as workspace.

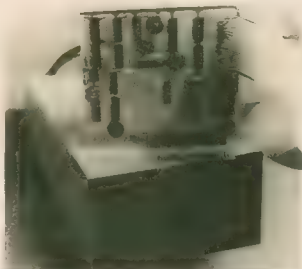
The commands can be written into any program by having the first line as LET \square = USR9999. This stores all the numbers as variables so that LET E = USR DSAVE etc can be used. The variable E will then return an error code which can be checked for operator or disc errors.

Although E is used all the way through the documentation as a way of calling these machine code routines, it is not listed as a reserved variable. Variables used by the system are the commands (which take up 240 bytes of variable storage), Dir, Dsave, Dload, Stat, Write, Read, Create, Kill, Newd and the transfer parameters FS, RS(128) and R.

Dir provides a directory (which takes up the whole of the first track of the disc) of programs and data in the form of file names. These file names consist of nine letters — six letters of the name of the file (no spaces) and three letters giving the file type separated by a full stop. The user inputs both when creating the fixed length data array which acts as a file on the disc.

Each file must be in multiples of 1.28K, as it can only be stored in whole tracks. Each track is divided into 10 sectors of 128 bytes which can be written to or read from by using RS to transfer the data from one sector in or out of memory.

FS carries the name of the file and R is used to tell the disc operating system which sector to use. There are up to 390



Macronics disc drive for the ZX81 can store up to 48K on single sided, single density discs. It has a loading speed of 24 seconds per 16K program.

sectors available on a 48K (40 track) disc. All \square this is done in Fast mode with the screen blank.

Files cannot be overwritten and must be killed to get rid of them. Thus copying a file must be done by giving it a new name.

Newd prepares a new disc for use by checking it and installing the directory track. Stat will either give the number of free sectors on the disc or the length of the file named in FS. Dload and Dsave will load or save programs to disc and will allow programs to auto-run as well.

The documentation is good, but I would have liked to see a list of commands on one page as quick reference guide. Also, using a one dimensioned string array ie

DimRS(1,128) instead of DimRS(128) would mean that the string could be input and thus save on memory.

It is a pity that larger Ram packs cannot be used as a full 48K of Basic memory would make better use of the disc. At the moment all 48K Ram packs also overlay the 8K—16K space with Ram which stops the operation of the disc's Rom.

Conclusion

This system will only work on the ZX80 and ZX81. It's greatest challenger will be Sinclair's microdrive. When you compare the cost, it is cheaper to buy a 48K Spectrum and a Microdrive. But ZX81 users may not want to rewrite software. **SA**

Thermal printer

Computer Keyboards, Glendale Park, Fernbank Road, Ascot, Berkshire
Price: £110.97 inc VAT and postage

This is a thermal printer for the ZX81 and ZX80 with 8K Rom. It provides three commands similar to Lprint, List and copy via User routines located in a 2K Rom contained in the CAI O black box.

There is a port located in the 14K-16K area of the box's memory map and the three Eprom sockets are mapped into the 8K-14K space. There are also a number of empty sockets on the board, which allow you to upgrade to a RS232 two way modem interface.

The CAI printer is considerably larger than the Sinclair printer (10½ × 7½ × 4 in) and comes in a white box with three controls, plus a flip up cover for the paper

roll. The controls are Power on, Paper advance and a lever to lift up the printing heads for inserting paper. The paper roll is twice the length of the Sinclair paper and half the price (£1.30 a roll).

All the commands for the printer are in the form of Let \square = User(XXX) and the only variable used in \square is, which contains the string to be Lprinted. The printer will stop with an error code if it is not in Fast mode (which has to be set by the user). \square p has not been set or the printer is faulty.

Conclusion

This alternative to the Sinclair printer is four times cheaper on paper and is cheaper than spending £200-£300 on a paper printer. It is expensive, but don't forget you also get a 16 line port and the option to add an RS232 interface as well. The cost of the extra components I understand will be about £40. The fast mode must be specified by the user which is annoying. **SA**

Open Forum

Open Forum is for you to publish your programs and ideas.
It is important that your programs are bug free before you send them in. We cannot test all of them.
Contributions should be sent to: Popular Computing Weekly, Hobhouse Court,
19 Whitcomb Street, London WC2H 7HF.

How to contribute

Each week the editor goes through all the programs that you send to Open Forum in order to find the Program of the Week.

The author of that program will qualify for DOUBLE the usual fee we pay for published programs.
(The usual fee is £10.)

Presentation hints

Programs which are most likely to be considered for the Program of the Week will be computer printed and accompanied by a cassette.

The program will be well documented, the documentation being typed with a double spacing between each line.

The documentation should start with a general description of the program and then give some detail of how the program has been constructed and of its special features.

Listings taken from a ZX Printer should be cut into convenient lengths and carefully stuck down on to white paper, avoiding any creasing.

Please enclose a stamped, self-addressed envelope.

Super Expander

on Vic-20

I am sure there are a large number of Vic20 owners who have the Super Expander cartridge. I have not yet seen your magazine publish any programs which make use of it.

Here are four short programs, each of which should be run with the cartridge plugged in.

String & nails

This program shows how curves can be created by using straight lines. The program repeats in seven different colours, and then restarts. The listing is straightforward.

Line 5 Begins the loop and change the colours, clears the screen (SNCCLR), and sets the colour.

Lines 10-40 Draw the outer pattern.
Lines 50-80 Draw the inner pattern with a short delay at the end of line 80.

Circle cones

This program draws two cones over each other to show how multiple circles can draw straight lines. The program repeats in seven different colours.

Line 100 Sets the loop for the seven colours and sets the colour.
Lines 20-40 Draw the first cone.
Lines 50-70 Draw the second cone.
Line 70 Also clears the screen for the next colour.

Tunnel vision

This program gives the effect of looking down a tunnel with an object coming towards you and then going away. The program repeats in seven different colours.

Line 10 Sets the loop for the seven colours and changes graphic modes for effect.

Lines 30-35 is the object going away from you.
Lines 40-50 is the object coming towards you.

Wine glass

This program draws a wine glass and then 'paints' the background and fills the glass with colour. Note that graphics mode 1 must be used to use the colours here:

Line 10 Sets a white border, white background, blue characters and light yellow for the auxiliary colour.
Lines 20-30 Draw the top of the glass.
Lines 40-50 Draw the stem of the glass.
Lines 60-70 Draw the base of the glass.
Line 80 Fills the glass. Then paints the background in the auxiliary colour. The colour is then changed to yellow border and green characters.
Line 90 There are 20 half density blocks here. The *Clear* command is the same as the *Print* statement as on the ZXB1.

```
12 REM STRING AND NAILS USING THE SUPER EXPANDER CARTRIDGE BY A.HORRELL
13 GRAPHIC2 FORA=1707 SNCCLR COLOR0:0,0,0
14 FORV=0:1023STEP40:DRAW2,0,VTD1023-V,0 NEXT
20 FORV=0:1023STEP40:DRAW2,V,1023700-V NEXT
30 FORV=0:1023STEP40:DRAW2,V,1023700-V,1023-V NEXT
40 FORV=0:1023STEP40:DRAW2,1023,1023-VTD1023-V,0 NEXT FORU=170500 NEXT
50 FORV=0:1023STEP40:DRAW2,512,VTD512-V,512 NEXT
60 FORV=0:1023STEP40:DRAW2,V,5127512,512-V NEXT
70 FORV=0:1023STEP40:DRAW2,V,5127512,V,512 NEXT
80 FORV=0:1023STEP40:DRAW2,512,1023-VTD512-V,512 NEXT FORU=170999 NEXT NEXT RUN
```

READV.

```
5 REM CIRCLE CONES USING SUPER EXPANDER CARTRIDGE BY A.HORRELL
10 GRAPHIC2
15 FORC=1707 COLOR0:0,0,0
20 A=320 FORU=2007012STEP20
30 CIRCLE2-U,512-A,7,0
40 A=A-12 NEXT
50 A=320 FORU=2007012STEP20
60 CIRCLE2,1023-U,512-A,7,0
70 A=A-12 NEXT FORC=1701000 NEXT SNCCLR NEXT
```

PERDV.

to next page

13



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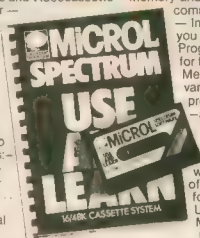
command - Display File Memory Map

- Important PEEK and POKE locations you won't find in your Spectrum manual.

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Open Forum

from page 13

For Squash practice game

16771. @ normally 133

16529. 133 normally 14

16537. @ normally 24

```

16514 2A 0C 40 06 06
16515 41 08 08 14 10
16524 7B 23 0E 14 10
16525 08 08 08 14 10
16533 1B FD 08 1B FD
16539 1B FD 08 1B FD
16549 08 08 08 08 08
16554 03 08 08 08 08
16559 40 08 08 08 08
16564 FD 08 08 08 08
16569 2A 3C 08 08 08
16574 1B FD 08 08 08
16584 07 1B FD 08 08
16589 08 13 08 08 08
16594 08 13 08 08 08
16599 08 13 08 08 08
16604 40 40 77 C9 FE
16609 03 28 07 08 08
16614 32 32 40 40 40
16619 08 08 08 08 08
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16725 04 10 20 40
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16796 08 10 20 40
16797 08 10 20 40
16798 08 10 20 40
16799 08 10 20 40
16800 08 10 20 40

```

PROGRAM OF THE WEEK

```

4 RAND
5 POKE 16446,10
6 POKE 16447,10
7 POKE 16448,10
8 POKE 16449,10
9 POKE 16450,10
10 LET 11=0
11 POKE 16430,2
12 POKE 16561,175
13 POKE 16562,21-PEEK 16704
14 POKE 16563,21-PEEK 16810
15 IF PEEK 16569=14 THEN PRINT
AT 0.4 "PLAYER 1":TAB 20:PLAYE
R 1
16 PRINT AT 1.0:
17 LET 12=0
18 LET A=USR 16514
19 POKE 16448,0
20 POKE 16449,0
21 POKE 16450,0
22 POKE 16451,0
23 POKE 16452,0
24 POKE 16453,0
25 POKE 16454,0
26 POKE 16455,0
27 POKE 16456,0
28 POKE 16457,0
29 POKE 16458,0
30 IF PEEK 16449=1 THEN GOTO 1
40
50 LET 13=5111
100 POKE 16561,INT (RAND*2)+33
110 (RAND*4+1)PEEK 16701-511
120 LET 16445,1
130 GOTO 25
140 GOTO 25
150 LET 16446,1
160 POKE 16561,INT (RAND*2)+33
170 (RAND*4+1)PEEK 16701+1
180 POKE 16443,0
190 GOTO 25

```

Tennis
by Brian Cadger

Aeroplane

on Spectrum

An aeroplane from which you drop bombs to destroy an alien city, flies across the screen. If you manage to destroy the city you can go on to the next city and continue to build up your score.

You can run out of fuel (level displayed at the top of the screen), you can run out of bombs or you can crash.

To make the game harder you can reduce the number of bombs (v) in Line 5, or you can make the fuel run out faster in Line 605 (eg Let f=f-0.5). You can only have one bomb dropping at a time. To load the program LOAD "Aeroplane".

The variables of the program are as follows:

- s = Score
- v = Number of bombs remaining
- f = Fuel
- a,b = Co-ordinates of buildings
- x,y = Co-ordinates of plane
- p,q = Co-ordinates of bomb
- d = Number of building blocks in the city

Line 10 Asks if you want instructions. Instructions are from Line 8999 to 9100

Lines 70 to 95 set up user graphics

graphic a = exploding building

q = bomb

p = building

Lines 97 to 130 print a random city — obtained by graphic p

Line 125 counts the number of buildings

Line 140 prints the fuel gauge

Lines 200 to 470 set up user graphics

graphic a = fat of plane

i = body of plane

i = nose of plane

Line 600 prints plane

To do this use "space, graphic a", graphic i, graphic i

Line 691 finds out if the space in front of the plane is a building (ATTR = 50). If it is then GOTO 710 (plane explodes and program re-starts)

Line 605 reduces the fuel, if the plane flies across y co-ordinate 5.

Line 606 prints a space on the fuel gauge at i decrements

Line 607 When fuel runs out (f=5) the plane crashes (Line 6000)

Line 670 moves plane up when Key "7" is pressed

Line 680 moves plane down when Key "5" is pressed

Line 645 prints Score

Line 647 prints Bombs left

Line 648 prints High Score

Line 650 drops a bomb when key "0" is pressed and finds out if no bombs are left (ie GOTO 900)

Line 655 finds if a bomb has been dropped. If it has not (if p=q=0) then it jumps the bomb dropping

Line 660 drops the bomb

Line 667 finds if bomb has hit building (ATTR=50), prints exploding building, resets p and q to 0 and adds 10 to the score. The explosion is obtained by a graphic a

Line 670 prints the bomb — obtained by a graphic q

Line 690 finds if the buildings have been destroyed. If they have (ie d=510) then GOTO 880

Line 710 prints exploding plane, obtained by "graphic a, graphic a, graphic a, graphic a"

Line 730 Game restarts

Line 800 gives instructions at the end of a city

Line 830 introduces a variable, i, for a series of beeps

Line 800 Game restarts

Line 900 gives instructions after running out of bombs

Line 900 prints plane crashing after running out of fuel. Plane is obtained by "space, graphic a, graphic i, graphic i"

Line 902 prints plane crashing if it hits the ground. Explosion is obtained by "graphic a, graphic a, graphic a, graphic a"

Line 903 finds if falling plane crashes into building (ATTR=50)

Lines 990 to 9100 print instructions

```

10 IF 0 THEN PRINT "DO YOU WANT INSTRUCTIONS?"
20 LET 1=0
30 IF 1 THEN GOTO 10
40 LET 1=1
50 GOTO 10
60 LET 1=0
70 GOTO 10
80 LET 1=1
90 GOTO 10
100 LET 1=0
110 GOTO 10
120 LET 1=1
130 GOTO 10
140 LET 1=0
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17

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1 REM *** 1700
2 REM HOOKUP TO VIC
3 GO TO 1700
4 PRINT "VIC 20"
5 GOTO 1700
6 REM *** 1700
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```

Scramble

Vic20

This is a version of the popular arcade game. Your sector has been given the task of destroying the planet Lomillator. The other ships have been destroyed by surface nuclear missiles. The mission is in your hands.

Your spies have managed to disable the tunnel's defensive system, so all you have to do is destroy as much as possible in the tunnel. The tunnel is made up of cliffs and valleys which makes some things impossible to destroy.

Although there is a safe path through the tunnel you must guide your ship, so that you can destroy the vital fuel dumps and so you can continue on your mission a little while longer.

At the top of the screen the running score and amount of fuel remaining is shown. The best score for the game so far is 820.

All keyboard directions are shown in the instructions. The program runs on the unexpanded Vic, but can be used without any modification with any amount of memory.

Program notes:
Lines

- 6-10 Set-up of variables according to amount of memory
- 1008-2005 Move screen by one space to the left
- 2007-2014 End of program
- 2101-3145 Create the landscape
- 3150-3210 Check which key is pressed
- 8002-9002 Explosion when hit occurs, and adjust score
- 9500-9701 Check if ship crashes
- 10000-10004 End of program
- 11000-12110 Explosion of ship
- 15000-15019 Instructions

```

10 REM *****
11  ** Planet By D. Ellis 88
12  *****
13
14 MODE 2
15 VDU 23,0,11,01010101
16 PRINT TAB(1,2);PROCring(1)
17 ***Planets***
18 REM Plot stars and redefine
19   flashing colours.
20 FOR XX=8 TO 100
21   VDU 19,XX,7101
22   GCOL 0,XX
23   FOR YX=0 TO 10
24     PLOT 69,RND(1279),RND(1023)
25   NEXT
26 NEXT
27 VDU 19,1,2101:GCOL 0,1
28 MOVE 0,0:DRAW 1279,0:DRAW 1279,1023
29 DRAMA,1023:DRAMA,0
30 REM Draw bottom half of planet
31 GCOL 0,1
32 PROCcircle(640,512,-200)
33 REM Draw rings
34 FOR AL=600 TO 350 STEP -50
35   PROCring(640,512,XX)
36 NEXT
37 REM Draw top half of planet
38 GCOL 0,1
39 PROCcircle(640,512,200)
40 REM Animate drawing
41 VDU 23,0,11,01010101
42 END
43
300 Draw one Half of the planet.
310
320 DEF PROCcircle(XX,YX,XX)
330 LOCAL AX,BX,CX,CX=REARX
340 FOR AX=0 TO RX STEP 50/RX
350   BX=50*(CX-AL)/AL
360   MOVE XX-BX,YX+BX
370   DRAW AX+BX,YX+BX
380   NEXT
390 ENDPROC
400
410 Draw rings.
420
430 DEF PROCring(XX,YX,RX)
440 LOCAL AX,BX,CX,DX
450 DX=B
460 FOR A=0 TO 240 STEP PI/24
470   BX=MIN(A)*RX+XX:CY=BX*(BX-XX)
480   DIVS=CDB(A)*RX:DIVS+YX
490   GCOL 0,DX:DX=DX+1
500   IF A=ROTHER MOVE BX,CX
510   ELSE DRAW BX,CX
520 NEXT
530 ENDPROC
540
550 Cycle through colours setting
560 one to black each time
570
580 DEF PROCcycle
590 LOCAL AX,BX,CX,XX
600 REPEAT
610 FOR AL=B TO 15

```

Scramble
by Neil Ekersley

Planet

on BBC Micro

This program produces an animated picture of Saturn by revolving the rings. The program starts by drawing stars followed by Saturn itself, then after the drawing is finished the program animates the rings.

The program works by redefining the flashing colours in mode 2. The program starts by drawing random stars (Lines 50 to 120) and setting the flashing colours to white.

Then the lower half of Saturn is drawn (Line 170) using *Procircle*. The rings are then drawn using *Procring*, which draws a 48 sided ellipse containing all the flashing colours in sequence.

The top half of Saturn is drawn, which also erases the rings behind Saturn. The animation is then produced by *Procycle* which cycles through all the flashing colours setting one to black and the rest to white.

Since the rings are drawn using these colours in sequence, black bands will be seen to circle the planet.

to next page

Open Forum

from previous page

```

590      FOR BX=2 TO 15
600 IF BX=AX THEN VDU119,BX,010 ELSE
IF BX=7 THEN VDU 19,BX,7101 ELSE
VDU 19,BX,(BX-CX)MOD6+21010
610      NEXT
620      TX=TIME:REPEAT UNTIL
TIME>TX+25
630      CX=CX+1
640      NEXT
650 UNTIL INKEY<0> <-1
660 ENDPROC
670
680      Print string list of
        colours
690
700 DEF PROCstrng(A$)
710 LOCAL AX
720 FOR AX=1 TO LEN(A$)
730 : COLOUR AX MOD 6 + 2
740 : PRINT MID$(A$,AX,1)
750 NEXT
760 ENDPROC
770
780      Print Screen onto the printer
790
800 DEF PROCscreen
810 CALL dump
820 ENDPROC
830
840      Assemble routines

```

Planet

by David Elliot

Morse

on Spectrum

"Morse" is intended for practice. Phrases may be continuously repeated, giving the operator a chance to learn combinations of words or characters.

The morse symbols are printed along-

```

10 REM 000000
20 REM 000100
30 REM 000200
40 REM 000300
50 REM 000400
60 REM 000500
70 REM 000600
80 REM 000700
90 REM 000800
100 REM 000900
110 REM 001000
120 REM 001100
130 REM 001200
140 REM 001300
150 REM 001400
160 REM 001500
170 REM 001600
180 REM 001700
190 REM 001800
200 REM 001900
210 REM 002000
220 REM 002100
230 REM 002200
240 REM 002300
250 REM 002400
260 REM 002500
270 REM 002600
280 REM 002700
290 REM 002800
300 REM 002900
310 REM 003000
320 REM 003100
330 REM 003200
340 REM 003300
350 REM 003400
360 REM 003500
370 REM 003600
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390 REM 003800
400 REM 003900
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890 REM 008800
900 REM 008900
910 REM 009000
920 REM 009100
930 REM 009200
940 REM 009300
950 REM 009400
960 REM 009500
970 REM 009600
980 REM 009700
990 REM 009800
1000 REM 009900

```

side each letter and the whole message ■
reprinted

Line 70 can be readily changed to suit the working speed, 0.11 being as slow as a beginner would require.

Line 320 ensures no stopping when the screen fills — ie it is an auto-scroll. Line 140 ensures that only capital Ascii codes are used.

```

240 PRINT AS:.....
250 PRINT
260 PRINT "Another Message"
270 GOTO 10
280 END
290
300
310
320
330
340
350 IF 1000000 THEN GOTO 370
360
370 THEN CLS
380 PRINT 25550
390 STOP
400
410 INKEY$=""
420 THEN CLS
430
440
450
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520
530
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550
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Morse
by Len Winsor

A GREAT NEW COMPETITION WORTH £THOUSANDS TO THE WINNER

Whizz-Kid '82

Fancy your chances?

F We're looking for a bright young thing who can out-shine all the commercial software houses and come up with a sparkling new program that can be marketed commercially.

We want you to prove you can write a selling program and if you win the competition you'll be well on the way to making big money.

The winner will receive:

1. A Dragon 32 computer.
2. Advice from *Popular Computing Weekly* on how to market and sell the winning software and how to form and finance the company to do so.
3. £2,000-worth of free advertising in *Popular Computing Weekly*.

The winner will be the author who submits the most commercially viable program together with a written outline of the author's own proposals on how he would run his software house and why he would like to do it. The judge will be *Popular Computing Weekly* editor, Brendon Gore.

If a number of equally good and commercially viable programs are submitted the decision of the overall winner will be based on the best accompanying written outline of the author's proposals for running a software house.



Entry to the award scheme must be accompanied by at least four out of five of the numbered coupons published in *Popular Computing Weekly* throughout September. The closing date for the competition is October 18. The winning entry will be announced in the issue published on November 18.

Rutledge

1. There is no limit on the number of entries you can send in, but each entry must be accompanied by four differently numbered competition coupons.
2. Closing date for entries is October 18, 1982.
3. The names of the winners will be announced in the November 18 issue of *Popular Computing Weekly*.
4. The Judges' decision is final.
5. No employees of Sunshine Publications Ltd. or their families, will be eligible to enter the competition.

Popular Computing Weekly

Whizz-Kid '82 Scheme

Fill in this coupon. When you have collected four differently numbered coupons, send them with your program to: *Popular Computing Weekly*, Whizz-Kid '62, Hobhouse Court, 11 Whitcomb Street, London WC2.

NAME: _____

ADDRESS:

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[illegible]

5

Spectrum

In this new slot various contributors explore different aspects of the ZX Spectrum.

Function line displayed in 3-D graphics

Ian Reynolds gives a three dimensional view of plotting.

This program runs on a 16K or 48K Spectrum. It produces a three dimensional view of the function held at line 1010. You can input any function at line 1010 and produce stunning effects on the screen.

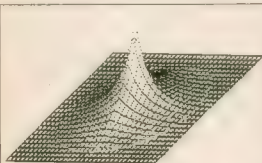
There is a simple, but very effective, "hidden line removal" routine comprised of lines 5, 10, 1022, 1023, 1026, 1050 and 1060.

When run, the program will request "resolution", which determines the spacing between the points plotted. A value of four gives a detailed plot, 10 gives a reasonable plot and 20 produces a fast but crude display. A resolution of four takes between 15 and 25 minutes, depending on the function at line 1010.

Experimenting with different functions and resolutions will give you some idea of the Spectrum's graphics capabilities. The following examples produce interesting displays:

```
Resolution Line 1010
4      LET t = EXP t/80
10     LET t = (SIN(t)*3) + COS(t)/4
5      LET t = LN ABS COS(t)/10
10     LET t = SIN COS (4*t)/10
20     LET t = - SIN(t) - COS(t)/2
```

```
1 BORDER 0: PAPER 0: CLS
3 INPUT "resolution" : s
5 DIM p(250,2)
10 FOR f=1 TO 250: LET p(f,2)=
255: IF f>140 THEN LET p(f,2)=f
12 NEXT f: BEEP .5,30
15 FOR f=-50 TO 50 STEP s
20 LET a=f
25 LET b=50-ABS f
30 FOR g=-70 TO 70
35 LET c=70-ABS g
40 GO SUB 1000
50 NEXT g
55 IF f=50 THEN STOP
60 FOR a=f+1 TO f+s-1
65 LET b=50-ABS a
70 FOR g=-70 TO 70 STEP s
75 LET c=70-ABS g
80 GO SUB 1000
90 NEXT g
100 NEXT a
110 NEXT f
1000 LET t=b*c/800
1005 LET r=a+g+121
1010 LET t=-EXP t/80
1020 LET t=INT (60+a-t*50)
1022 IF f=-50 THEN LET p(r,2)=t
1023 IF t<p(r,1) THEN GO TO 1050
1025 INK 6
1026 LET p(r,1)=t
1027 IF t<0 THEN LET t=0
1028 IF t>175 THEN LET t=175
1035 PLOT r,t
1040 RETURN
1050 IF t=p(r,2) THEN RETURN
1060 LET p(r,2)=t
1070 INK 5
1080 GO TO 1027
```



1010 LET t = -EXP t/80



1010 LET t = COS (t*4)/6

Programming

Dots and dashes fall for beeps

Paul Newman presents a
morse code trainer for the
Spectrum.

This short program will allow the Spectrum to *Beep* morse characters as they are typed on the keyboard. The character speed as given is quite slow and may be altered to suit by a simple change to line 35. In-code comments should explain most lines, except for line 10 where the morse characters are coded into a *Data* statement.

The morse dots and dashes are represented as binary 11 and 1 respectively. Thus the character "L" which is dot, dash, dot, dot, in morse code, may be represented as the binary notation 0100. In order that successive division by two (effectively binary division) may "strip" each binary digit off in the correct order, the notation is reversed — viz 0010. Finally, the binary notation is given a "guard bit" to form the complete binary representation of "L" — 10010 — which is binary for 18.

The data statement in line 10 contains the representation for 0–9 and A–Z. Note that they are given in the order groupings recommended by the Radio Society of Great Britain (EISH/TMO etc) which are specially designed to assist in the learning of morse code. I have done this way to help the user to design his own morse code tutor.

When learning morse code, it is fruitless learning the 'dots & dashes'. The only way of becoming proficient at morse is to learn how each letter sounds.

When altering line 35, remember to preserve the 1:3 dot:dash ratio. If you are seriously learning morse, alter line 35 to BEEP .13+.26*(x=1),0 to give you a reasonably slow character speed. Factors of .07 and .14 will produce a character speed of about 12 words per minute, which is the Radio Amateurs examination speed requirement. Text should be typed in lower case.

Most of the remaining details of the program are indicated in the *Rem* statements.

The Spectrum can be connected to a radio transmitter using a simple one-chip interface and I/O port.



Paul Newman, founder of the Sinclair Amateur Radio User Group.

Paul Newman is the founder of SARUG UK, the Sinclair Amateur Radio Users Group. He has long been an amateur radio enthusiast. During 1980 he became interested in using microcomputers to control radio equipment. Early in 1981 he became the first British member of ASARUG, the American Sinclair radio enthusiasts group. In November 1981 he formed the present UK group, SARUG UK. Mem-

bers of the group keep in touch over the air and through the pages of the SARUG newsletter which he edits. The group now has 175 members. Membership is £5 and is open to all amateur radio licence holders or anyone with a proven interest in amateur radio. For further information contact Paul Newman (G4 1NP), 3 Red House Lane, Leiston, Suffolk.

```
1 REM morse keyboard program
2 SPECTRUM 16k P NEWMAN
3 DATA 6,17,21,9,2,20,11,16,4
4 ,30,13,18,7,5,15,22,27,10,8,3,12
5 ,24,14,25,29,19,63,62,60,56,48,3
6 ,2,33,35,39,47,63 REM morse char
7 acter data
8 11 DIM z(36): REM storage for
9 characters
10 FOR j=1 TO 36: READ n: LET
11 z(j)=n: NEXT j: REM store them i
12 n array z
13 CLS: PRINT AT 0,0: FLASH 1
14 "morse keyboard ready"
15 LET a$=INKEY$: IF a$="" THEN
16 GO TO 22: REM get a key press
17 IF a$=" " THEN PRINT " ":
18 GO TO 22
19 LET p=CODE a$-96: IF p>=48
20 AND p<=57 THEN LET p=p-78: GO
21 TO 26: IF p<1 OR p>122 THEN GO T
22 O 22: REM only valid keys 0-9,a-
23 z
24 PRINT a$,: LET n=z(p): REM
25 find data
26 LET x=n-INT (n/2)*2: REM bi
27 nary division
28 BEEP .10+.20*(x=1),0: REM x
29 =1 is dash, beep .3, dot=0 so beep
30 .1
31 LET n=INT (n/2): REM more b
32 i division
33 GO TO 28-7*(n=1): REM get
34 another key if n<2
```

Peek & poke

Peek your problems to our address. Ian Beardsmore will poke back an answer.

TO REVERSE

John Grain of Mill Street, Witney, Oxford, writes.

Q Could you please tell me if there is any way of using a statement **III** reverse a number just input into the computer (ZX Spectrum), for example to change 1472 to 27147?

I am writing a business program and need this operation to help me with an index code that I am developing. I hope you can help.

A This has already been done. This neat solution was developed by Jeremy Ruston:

```
10 INPUT AS
20 LET BS = ""
30 FOR T = 1 TO LEN(AS)
40 LET BS = AS (T) + BS
50 NEXT T
60 PRINT BS
```

TRANSMITTER LINK-UPS

Sean Connelly of Valley Road, Macclesfield, Cheshire, writes:

Q I will soon be getting a ZX Spectrum. As a great radio enthusiast, I would like to connect my two channel radio transmitter to my computer. Could you suggest an input/output port to do the job? Would a digital/analogue converter be suitable? I would be able to do any such modification myself if necessary.

A The direct answer is that I do not know how to connect a Spectrum to a two way transmitter. If you have access to a copy of our July 1 edition you will see it featured a whole page about SARUG UK, the Sinclair Amateur Radio Users Group in the United Kingdom.

To link a ZX81 to a transmitter, the group reckons that you need a 356 byte program and a I/O port with a single chip interface. For further information contact Paul Newman, (G4INP), 3 Red House Lane, Leiston, Suffolk.

If you find that you still need help, try Stephen

Adam's book *20 Simple Electronic Projects For the ZX81 and other Computers*. One of the programs in there is an A/D converter. The book is available from Interface, 44-46 Earls Court Road, London W8 6EJ.

SHARP'S THE WORD

David Hale of Mushoka Avenue, Bents Green, Sheffield, writes:

Q I am looking for a hand held computer that can be used to assist me in my model car racing. It's task would be to take lap times to 1/100th of a second — times taken by hand operated press button — then to time a second car in the same way. The information would be used to immediately calculate where the two cars should be in relation to each other in a given period of time or number of laps, given various speeds.

It would be useful if it could emit sounds instead of necessarily displaying the answer on a screen. I have considered the Sharp PC 1211, but it can only work to 1/10th of a second and **III** does not have sound.

Last November, Panasonic had a hand held computer at the NEC Birmingham, which could work to 1/50th of a second and had a range of eight octaves. The problem is that it is as yet only available **III** the US and I do not know if it will do the job. Should I try to import one? Alternatively, could you advise me of another hand held micro that would do the job?

A I have held this letter for a few weeks, vainly waiting a reply from National Panasonic. The company over here know very little. The only information they have is a glossy sales leaflet that they promised to send me some weeks ago. It still has not arrived.

All I can add to what you already know is that it is due for launch over here sometime in mid-1983. I would not advise you to import one on such little knowledge.

As for an alternative, the only one that springs to mind is the new Sharp PC 1500. It is hand held, and does have a tone generator on board. The company to contact, not only about the Sharp but about hand held micros in general, is: Tempus, 38 Burleigh Street, Cambridge CB1 1DG.

EXORCIST'S SUCCESS

Miles Clarke of Worcester Road, Oxford, writes:

Q I am trying to write a program on my Vic20 that will store information. I want to enter numbers and other facts on tape, for use **III** a later time. However, when I Load the tape and Run it, the information disappears, even if it was on the screen. How do I store information on a tape?

A The Run command clears all variables and starts the program again from scratch. You do not say how you input the information, but I presume that you are using something like Input A\$. This can be overcome by using the Goto command.

You do not give details of the size of your program, nor how many variables you use for other things. All I can do is give a small sub-routine for storing information in a single string, which can be added to. Run the program initially, and thereafter always use Goto 30. This is true whether you want to add more information now, or at a later date after Loading. Of course, you can use Run if you want to clear the variable and start again.

```
10 INPUT AS
20 PRINT AS
30 INPUT BS
40 AS = AS + BS
50 PRINT AS
```

PROBLEMS OF TEMPERAMENT

Eric Smith of Lime Street, Grangemouth, Stirlingshire, writes:

Q I have a ZX81 and printer. I have noticed that the printer does not feed the paper very well and quite often

stops altogether. This problem only occurred when I started using paper ordered from Sinclair. Is there any answer to this or am I stuck with having to pull the paper through while printing?

While on this subject do you know if it is possible for the Sinclair printer to be interfaced with the TI158 calculator? The cost of the Texas Instruments printer **III** prohibitive.

A Problems seem to be cropping up with the ZX printer at the moment. Whether this is just a case of one bad batch, or an as yet undiagnosed design fault, I cannot say. I know that my printer has given me no problems whatsoever, though I have had to deal with a temperamental one here in the office.

First, check that the printer is clean and set up correctly. This may sound obvious, but dirt does build up and if it clogs the rubber roller it will stop the paper moving.

Another alternative is to slightly tighten the two springs that hold the lower roller in place. Finally, you can slightly widen the Vs in which the paper roll spindles are located, though I would not advise this unless all else has failed.

When pulling the paper through, do not pull it very hard. A firm even pressure is what is needed. If this does not work, then wiggle the paper from side to side. If the machine is not sparking, this will often get it going, though I do not know why.

I do not know if the Sinclair can be interfaced directly to the TI158, but I would doubt it. Your best bet is to get in touch with Microtanic Software of 235 Friern Road, Dulwich, London. They make a 'Printerface' which allows the ZX printer to be used with several computers.

● Stop agonising over that problem. Write to Ian Beardsmore, *Peek & Poke*, Popular Computing Weekly, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

Classified

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Davidson, 109 Highgate Lane, Farmborough, Hampshire

BBC MICRO Pools Predictor. Model A or B. Easy data entry. Uses powerful mathematical and statistical forecasting model. User friendly. On cassette with full instructions. £4.99.

Mayday Software, 181 Portland Crescent, Bismore, MA7 1LR

VIC20 SOFTWARE (unpublished). Two hit action games, "Meteors" and "Tender" for £4.00. Two easy to play beginners/younger children's games: "Fruit Gatherer" and "Spade-man" for £4.00. S & T Lepojovic, 2 Piccadilly Way, Chalfonts, GL52 5SD.

ZX81 16K plus software and magazines £70.00. Tel 891 3294 after 4.30 pm

ZX81 Machine Code Loader. Enter the exciting world of machine code 1K and 16K versions supplied. Both include Hex loading, saving, editing, running etc. Includes cassette and documentation. Only £1.95 from Chris Davison, 87 Seymour Road, Newton Abbot, Devon. TQ12 2PX

DK TRONICS 4K. Graphic ROM board with 1K U.D.G. RAM. £25. Telephone Chatterfield 201263 evenings

BYTE-MAN, with Star-Fighter and Bomber — three quality fast moving machine code games for the price of one. For the ZX81 16K. Why pay more for less? Only £2.95. "Windswept" 12 North Grove Drive, Leeds LS8 2NJ.

BBC MICRO MODEL B (avoid the quiver), various software and hardware, £380.00. Tel Horley (029-34) 4405.

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Professor Frank George's well known Football Pools Forecasting program is now available on the **SINCLAIR Z80 16K** and 8 other microcs

A Home Rule Forecast Program in preparation on
Article 1. Professor F. R. George
Baker, of Information Science
Department, Royal Street
Chalfonts St Giles, Bucks

SPECTRUM GAMES CASSETTE: Zombi, Life, Balloon, Manoe, E4 M Chambers, 6 Baresford Close, Parkstone, Poole, Dorset BH12 2HF

VIC20 for sale plus cassette deck. Super Expander joystick and software. In new, £220, worth £280. Phone Trowbridge 61409

ACORN ATOM 12/12K including Joystick, software and books. £160. Tel (0832) 666120

VIC HANGMAN, good graphics, entry checks, sound effects music, many other features. £2.75. A. Lambert, 19 Cedar Road, Marple, Cheshire

AT SOFTWARE presents a multi-game cassette for the Sinclair ZX Spectrum. Blitz, Dropout, Breakout, Racer and a UDG generator all on one tape for £9.95 or separately for £3.95. For details send a stamped addressed envelope to Mouse Hat, Bolney, Sussex RH17 5RY

SPECTRUM PROGRAMS. Word processor — screen editing, insert, replace, delete, word-wrap, justification, file-handling. £15. L-game, new, different, testing. £5. Graphics Generator makes it easy. £5. All include cassette plus instructions. Brian Hebbes, 6a Newlands Avenue, Southampton

PLAY DOMINOES against your ZX81. Different 16K game every "RUN" computer printed using E1, P. Aitken, 1 Clotchard Avenue, Mingeve G62 7JW

MINI MICRO COMPUTER for sale. DEC data system, digital PDP 11/23 including two disk drives, also separate VDU (VT100) and printer (DEC Writer 111). £5,000.00. Contact Ruffon UK Ltd., 061-228 2582.

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Educational and leisure programs
Space Academy 20K. Driving Test 20K. Invaluable States and Ladders 20K. England 20K. Sunnytop 10K (for young children). Many for just 150 for young children. Programs £4.95. Two for £5.00. SAE for details.

Send by return of post after cheque/PO for control. Max order 100.

SWIFT LINK SOFTWARE
116-120 WARDOUR STREET, W1V 4BT

ZX81 16K. Ram plus keyboard graphic Rom and software, £100.00. Tel Sheffield (0742) 365577

ZX SPECTRUM MISSILE COMMAND. 16-nes colour sound, fast moving graphics, bargain, only £2. P. Darling, Mill Lodge, Mill Green, Statham Aspal, Sloughmarket, Suffolk

STARTING FORTH by Leo Brodie, £13.75 including p & p. Access-Barleycard 0923-23324. Come and browse or send for lists. Walford Technical Books, 105 St Albans Road, Walford, Herts

Wanted, Spectrum 16/48K system, software, after 100 pm or anytime Sunday. 01-582181

ZX81 (CONVERTED 80) 16K Ram. Complete with pack, pocket books, cassette. £60.00. 01-582181

ZX SPECTRUM GAMES: Ten Minutes To Live, Air Attack, Unsunder Slaircase and Monster Maze, on cassette, £4.75. B. Baker, 87 Murray Avenue, Bromley, Kent BR1 3DJ. See for more details

SPECTRUM SPEAKER, volume control, cassette, complete, ready to use, £25.00 inclusive. J. Hunter, 11 Hatfield Close, Poole, Dorset

VIC20 and cassette unit plus Vic Revealed, joystick, swaders, Pacman, £150. Telephone Clitheroe 24516

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Work Force, 140 Willaden Avenue, Luton, Beds.

DUST COVERS for all computers, printers, disk drives, monitors, etc. VicBBC/Atom £2.95; Sharp MZ 80K, MZ 80A £5.50; Gemini-TINSPO £3.95. Printers £3.95. Please ring for other prices. Trade enquiries welcome. Access-Barleycard/cheque. Sherbourne Designs, 9 Loughton Home Farm Court, Welwyn Lane, Westbury, Wilt. Tel: 0283764 (24-hr service)

BBC MODEL A 32K, 8 months old with books and software. £315. Tel. Martin Crawley, 01-730 4544, ex 321 (office hours)

TINSPO SOFTWARE on tape, from £1.95. See list. ATU, 115 Crescent Drive South, Brighton, BN2 6SR

Swapshop

01-930 3386

Are you one of the thousands of owners of an old computer? Can you use it? Sell it? Buy it? Swap it? Through Swap Shop? In each issue between now and the end of October we will publish a FREE entry in Swap Shop for anyone who has a computer to sell. As you have no fee to place Swap Shop on 01 500 7266 and tell us your name, address, telephone number, the type and specification of the computer you have to sell — and the price you want for it.

Swap Shop is loaded to generate individuals who have old computers to sell. No more than 20 words may be found and the advertisement you supply must be printed in the computer. You may not include information about acquiring or software in particular. If you would prefer to write in with your code for Swap Shop please make your letter clear to: Swap Shop, Popular Computing Weekly, Robinson Court, 13 Whitcomb Street, London WC2 7JF

Swap Shop is run solely as a service to Popular Computing Weekly readers. We cannot accept any responsibility for any errors in publication or any copy used.

CLASSIFIED ADVERTISING RATES:

Line by line: For private individuals, 20p per word, minimum 10 words.

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Semi-display: £10 per single column centimetre, minimum length 3 cm. (Please supply A/W as PMT. Or supply rough setting instructions.)

Conditions: All copy for Classified section must be pre-paid. Cheques and postal orders should arrive at least two weeks before the publication date.

If you wish to discuss your ad, please ring Alastair Macintosh 01-930 3840.

Here's my classified ad.

(Please write your copy in capital letters on the lines below.)

I make this	words, at	per word so I owe you £
Name		
Address		
Telephone		

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I make this words, at per word so I owe you £

Name

Address

Telephone

Please cut out and send this form to: Classified Department, Popular Computing Weekly,

Hobhouse Court, 19 Whitcomb Street, London WC2

Competitions

Puzzle No 22

Here is the second of the Ancient Algorithms where cavemen rearrange piles of stones into other piles of stones in interesting ways.

What is being calculated this week?

Tony Roberts

Rules

The winner of the puzzle will be the reader who, in the opinion of *Popular Computing Weekly*, has submitted the best and most imaginative solution.

Envelopes containing entries should be clearly marked 'PUZZLE'.

The closing date for the competition is Tuesday, September 28.

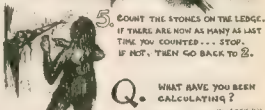
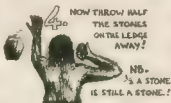
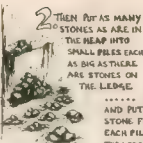
Solution to Puzzle No 18

To find the number of cars on each occasion use the formula $N \times (N + 1)/2$ to find successive triangular numbers, T . This expression can then be used in a program like the one shown here to find the answers:

```
10 LET C = 0
20 LET N = 2
30 LET T = N * (N + 1) / 2
40 LET X = SORT T
50 IF ABS (X - INT (X + 1E - 8)) < .0000001 THEN
  GOSUB 190
60 LET N = N + 1
```

```
70 GOTO 30
190 PRINT T
110 LET C = C + 1
120 IF C = 3 THEN STOP
130 RETURN
Line 50 checks to see if the square root of each
T is an integer (or near enough, allowing for the
accuracy of the square-root function). If the T
value is a square it is printed out and the
program will stop after three such numbers,
when C = 3.
```

On the first day there were 36 cars in the park.



Q. WHAT HAVE YOU BEEN CALCULATING?

Two weeks later there were 1225 cars present. The next possible number that is both a square and a triangle is 41,616. This is 204 squared so the car park is 204 spaces square. Since each space is 11.3 x 11.3 feet the car park is 2448 feet long and 1224 feet wide.

Winner of Puzzle No 18

The winner is P Ranklor, Rue Sauvage, Sampsons, Guernsey, Channel Islands, who receives £10. He adds: The last answer is more cars than in the whole of Guernsey!

ARTHUR KEEPS FIT

ARTHUR

IF YOU
SAY THIS

IF YOU
SAY THAT

IF WHITE
MAN FRIEND

IF WHITE
MAN EN

IF SAY
THIS IS

IF SAY
THIS WAS

IF MAN
FRIEND DOG

IF MAN
FRIEND MACH

IF THIS
IS ON

IF THIS
IS OFF

IF FRIEND
MACH DIG

IF FRIEND
MACH AN

IF IS
ON WHITE

IF IS
ON BLACK

IF MACH
DIG ARTH

IF AN
DIG AL

IF ON
WHITE MAN

IF ON
WHITE WOM

IF DIG
IT AL

IF AN
AL OG

Sinclair ZX Spectrum

**16K or 48K RAM...
full-size moving-
key keyboard...
colour and sound...
high-resolution
graphics...**

**From only
£125!**

First, there was the world-beating Sinclair ZX80. The first personal computer for under £100.

Then, the ZX81. With up to 16K RAM available, and the ZX Printer. Giving more power and more flexibility. Together, they've sold over 500,000 so far, to make Sinclair world leaders in personal computing. And the ZX81 remains the ideal low-cost introduction to computing.

Now there's the ZX Spectrum! With up to 48K of RAM. A full-size moving-key keyboard. Vivid colour and sound. High-resolution graphics. And a low price that's unrivalled.

Professional power— personal computer price!

The ZX Spectrum incorporates all the proven features of the ZX81. But its new 16K BASIC ROM dramatically increases your computing power.

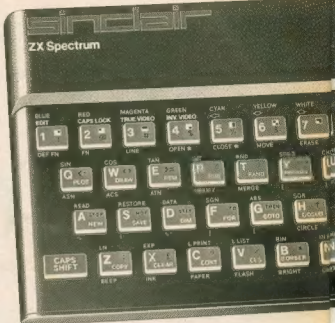
You have access to a range of 8 colours for foreground, background and border, together with a sound generator and high-resolution graphics.

You have the facility to support separate data files.

You have a choice of storage capacities (governed by the amount of RAM). 16K of RAM (which you can upgrade later to 48K of RAM) or a massive 48K of RAM.

Yet the price of the Spectrum 16K is an amazing £125! Even the popular 48K version costs only £175!

You may decide to begin with the 16K version. If so, you can still return it later for an upgrade. The cost? Around £60.



Ready to use today, easy to expand tomorrow

Your ZX Spectrum comes with a mains adaptor and all the necessary leads to connect to most cassette recorders and TVs (colour or black and white).

Employing Sinclair BASIC (now used in over 500,000 computers worldwide) the ZX Spectrum comes complete with two manuals which together represent a detailed course in BASIC programming. Whether you're a beginner or a competent programmer, you'll find them both of immense help. Depending on your computer experience, you'll quickly be moving into the colourful world of ZX Spectrum professional-level computing.

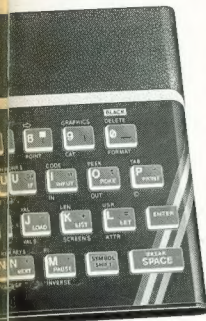
There's no need to stop there. The ZX Printer—available now—is fully compatible with the ZX Spectrum. And later this year there will be Microdrives for massive amounts of extra on-line storage, plus an RS232/network interface board.



Key features of the Sinclair ZX Spectrum

- Full colour—8 colours each for foreground, background and border, plus flashing and brightness-intensity control.
- Sound—BEEP command with variable pitch and duration.
- Massive RAM—16K or 48K.
- Full-size moving-key keyboard—all keys at normal typewriter pitch, with repeat facility on each key.
- High-resolution—256 dots horizontally x 192 vertically, each individually addressable for true high-resolution graphics.
- ASCII character set—with upper- and lower-case characters.
- Teletext-compatible—user software can generate 40 characters per line or other settings.
- High speed LOAD & SAVE—16K in 100 seconds via cassette, with VERIFY & MERGE for programs and separate data files.
- Sinclair 16K extended BASIC—incorporating unique 'one-touch' keyword entry, syntax check, and report codes.

um



RS232/network interface board

This interface, available later this year, will enable you to connect your ZX Spectrum to a whole host of printers, terminals and other computers.

The potential is enormous. And the astonishingly low price of only £20 is possible only because the operating systems are already designed into the ROM.

ZX Spectrum

Available only by mail order and only from

sinclair

Sinclair Research Ltd,
Stanhope Road, Camberley,
Surrey, GU15 3PS
Tel. Camberley (0276) 685311.

The ZX Printer – available now

Designed exclusively for use with the Sinclair ZX range of computers, the printer offers ZX Spectrum owners the full ASCII character set – including lower-case characters and high-resolution graphics.

A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. Printing speed is 50 characters per second, with 32 characters per line and 9 lines per vertical inch.

The ZX Printer connects to the rear of your ZX Spectrum. A roll of paper (65ft long and 4in wide) is supplied, along with full instructions. Further supplies of paper are available in packs of five rolls.



The ZX Microdrive – coming soon

The new Microdrives, designed especially for the ZX Spectrum, are set to change the face of personal computing.

Each Microdrive is capable of holding up to 100K bytes using a single interchangeable microfloppy.

The transfer rate is 16K bytes per second, with average access time of 3.5 seconds. And you'll be able to connect up to 8 ZX Microdrives to your ZX Spectrum.

All the BASIC commands required for the Microdrives are included on the Spectrum.

A remarkable breakthrough at a remarkable price. The Microdrives are available later this year, for around £50.



How to order your ZX Spectrum

BY PHONE – Access, Barclaycard or Trustcard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp needed coupon below. You can pay by cheque, postal order, Access,

Barclaycard or Trustcard.

EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR.

Order

Qty	Item	Code	Item Price	Total
			£	£
	Sinclair ZX Spectrum – 16K RAM version	100	125.00	
	Sinclair ZX Spectrum – 48K RAM version	101	175.00	
	Sinclair ZX Printer	27	59.95	
	Printer paper (pack of 5 rolls)	16	11.95	
	Postage and packing: orders under £100	28	2.95	
	orders over £100	29	4.95	
			Total £	

Please tick if you require a VAT receipt ☐

*I enclose a cheque/postal order payable to Sinclair Research Ltd for £

*Please charge to my Access/Barclaycard/Trustcard account no.

*Please delete/complete as applicable

Signature

PLEASE PRINT

Name: Mr/Mrs/Miss

Address

POC 899

FREEPOST – no stamp needed. Prices apply to UK only. Export prices on application.

Probably the fastest microcomputer in the universe the **JUPITER ACE** only £89.95.



All inclusive Price

For £89.95 you receive your Jupiter Ace, a mains adaptor, all the leads needed to connect to most cassette recorders and T.V.s (colour or black and white), a software catalogue and a manual.

The manual is a complete introduction to the world of personal computing and a course in FORTH programming on the Ace.

Even if you are a complete newcomer to computers, the manual will guide you step by step from first principles to confident programming.

The price includes postage packing and V.A.T.

Available soon

● 16K memory expansion for around £35.00. This will increase the memory of the Ace to 19K.

● A parallel printer interface for around £25.00. This will convert the Ace to anything from fast dot matrix to letter quality daisy wheel printers

Key Features

- Revolutionary microcomputer language FORTH.
- Full-size moving-key keyboard.
- User-defined high-resolution graphics.
- Programmable sound generator.
- Floating point arithmetic.
- Fast cassette interface.
- Upper and lower case ascii character set.
- 24 x 32 character flicker-free display.

The Jupiter Ace uses FORTH

The Ace is set apart from all other personal computers on the market by its use of a revolutionary language called 'FORTH'. Some computer languages are easy for humans to understand, others are easy for computers; FORTH is most unusual in being both. Its underlying principles are so simple that it takes even a newcomer to computers only a few minutes to learn how to do calculations on the Ace, yet the very same principles are powerful enough to allow you to invent your own extensions to the language itself.

At the same time, the memory-saving coded form used to store your programs inside the Ace allows it to obey them very fast — typically in less than a tenth of the time it would take to do the same thing using a different language. Amongst other things, this makes the Ace ideal for games.

FORTH's unique combination of speed, versatility and ease of programming has already made it a prime choice for professional applications as diverse as pub games and radio telescopes, and gained it an enthusiastic national user group. Now the Jupiter Ace can bring this addictive language into your own home.

Designed by Jupiter Cantab

Leading computer Designers Richard Altwasser and Steven Vickers have a reputation for pushing technology forwards. After playing the major role in creating the ZX Spectrum they formed Jupiter Cantab to develop their latest brainchild the Jupiter Ace.

Technical Specification

Hardware

Processor/Memory

Z80A running at 3.25 MHz.
8K bytes ROM 3K bytes RAM.

Input

40 moving-key keyboard with auto-repeat on every key.

Output

Memory-mapped 32 x 24 character display with high resolution user graphics. Output to drive normal UHF TV set on channel 36.

Sound

Provided by internal loudspeaker.

Cassette

Load Save ■ Verify at 1500 baud, separate data storage.

Software, FORTH

Data Structures

Integer, Floating point and String data may all be held as constants, variables or arrays with multiple dimensions and mixed data types.

Control Structures

IF-THEN-ELSE, DO-LOOP, BEGIN-WHILE-REPEAT, BEGIN-UNTIL, all may be mixed and nested to any depth.

Operators

Mathematical +, -, ×, ÷.
Logical AND, OR, NOT, XOR.
Comparison <, >, =.

Program Editing

FORTH words may be listed, edited and redefined. Comments are preserved when words are compiled.

Order Form

The Jupiter Ace is available only by mail order. Please allow up to 28 days for delivery.

Send cheque or postal order with the form to:—

JUPITER CANTAB, 22 FOXHOLLOW, BAR HILL, CAMBRIDGE CB3 9EP

Please send me:—

☐ JUPITER ACE MICROCOMPUTER(S) @ £89.95.

Name. Mr/Mrs/Miss

Address

